MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME III.] FOR THE WEEK ENDING JUNE 21, 1834. [NUMBER 6.

"Soon shall thy arm, unconquered steam! afar
Drag the slow barge, or drive the rapid car;
Or, on wide waving wings, expanded, bear
The flying chariots through the fields of air."—DARWIN.

FAIRMAN'S ROTARY STEAM ENGINE.

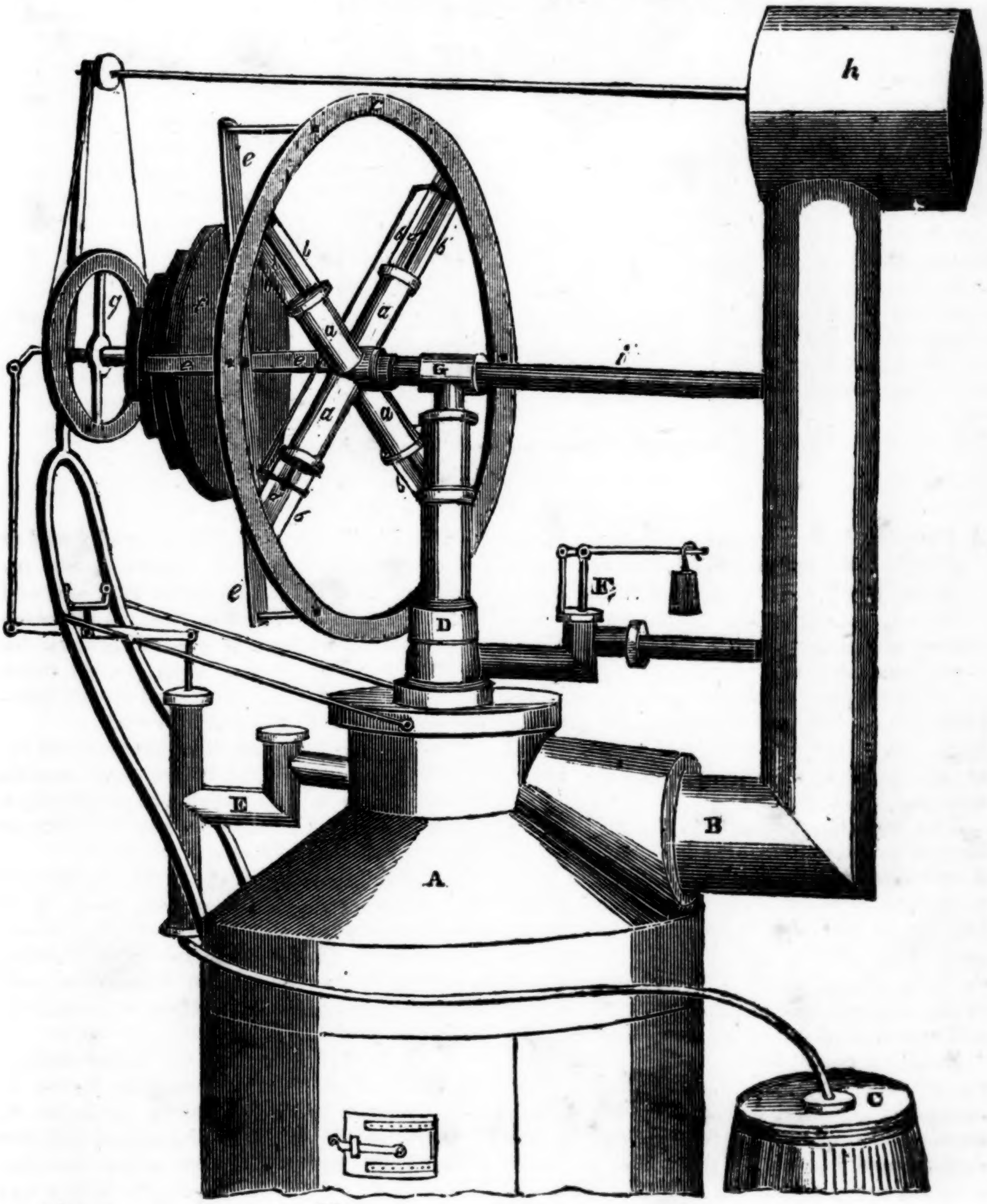
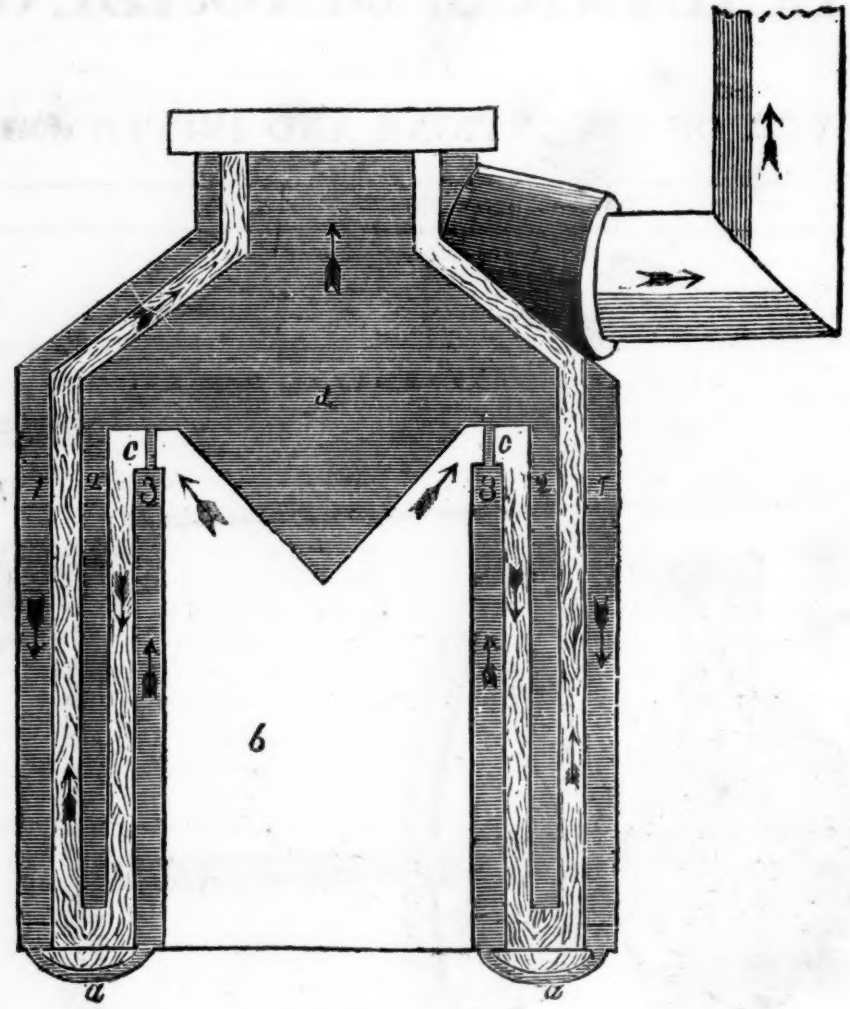


Fig. 2.



A Compound Reciprocating Rotary Steam Engine, and an Improved Boiler, invented by* SIMON FAIRMAN, *of Lansingburgh, New-York. [For the Mechanics' Magazine and Register of Inventions and Improvements.]

This engine and boiler may be used separately, or the two together, as may be most convenient; the engine may be connected with any other boiler, and the boiler with any other engine.

This invention presents to the public, in a fair and practical form, the long-sought *desideratum* of a steam engine producing a rotary motion, without undue complication and liability to disorder; without the inconvenience of fly wheels and cranks; and giving the full power of steam without being subject to the constant loss of impetus by the action and re-action of heavy masses of metal.

It will be easily discovered, by examining the drawing, that this engine and boiler, when connected together, will occupy but a very small portion of the space required by the engines and boilers of the same power in common use, and that the weight of both engine and boiler are equally reduced; and as the cost, especially of the engine, is also reduced, at least in the proportion to its size and weight, it follows of course that, in all cases where a rotary power is wanted, it must be entitled to a preference equal to all those savings and conveniences, and for all locomotive purposes, still much greater.

And it must be no less obvious, on inspecting the plan of the boiler, that, besides its compactness, it is capable of producing a given quantity of steam with less fuel than is required for the boilers now in use.

As in the annexed drawing the engine and boiler are connected together; and, as to communicate an idea of the boiler, it was necessary to give a sectional view, showing the form of the inside, the description will require a kind of mixed reference alternately from one drawing to the other.

A, figure 1, represents the boiler entire, the inside of which is explained by figure 2. The furnace door is shown in figure 1, through which the fuel is inserted into the furnace, *b*, figure 2. The water is contained in three concentric double hollow cy-

linders, numbered in figure 1,—1, 2, 3. It is received from the supply pump, E, figure 1, into the outer cylinder, No. 1, and passes thence through bent tubes, *a*, *a*, into the inner cylinder, No. 3, which forms the furnace, from which it passes through the tubes, *c*, *c*, figure 2, into the centre pan at the top, *d*, which pan is connected with the middle cylinder, No. 2, from which enclosure and pan it goes through the upright or main conductor, D, figure 1, to the engine.

The fire goes from the furnace, *b*, and the top of the inner cylinder, thence down between that and No. 2, and, passing under No. 2, goes up between that and No. 1, and out through the small pipe, B, figure 1 ; and, when necessary, the draught is accelerated by a blower in the cylinder, *n*. The bottom of the furnace has a grate and ash pan, which need no description.

The spaces between the double cylinders, and in the centre pan, in which the water and steam are contained, are shaded in the sectional view, and the furnace and spars between the cylinders through which the fire passes are left white.

C, figure 1, represents the water tank; F, the safety valve; G, the horizontal pipe forming part of axis, through which the steam is conducted to and from the engine.

a, *a*, *a*, *a*, are four cylinders, in all respects similar to those of the common reciprocating steam engine; which cylinders stand at right angles with each other, with their bottoms resting upon a cylindrical hub, or centre; the cylinders of course forming a cross.

b, *b*, &c. are the slide rods, part of which only are seen. The bottoms of the slide rods are attached to the flanges round the tops of the cylinders, and their tops to a rim of cast iron, *c*, which rim also steadies and supports the tops of the cylinders by four straps, or parts of arms, *d*, *d*, *d*, *d*, which are bolted to the tops of the cylinders.

e, *e*, *e*, *e*, are four arms, connected with said rim by studs of sufficient length to leave room between said arms and the cylinders for the connecting rods to revolve, and to which arms is attached the main or driving pulley, *f*, or in place thereof a cog-wheel, as the case may require.

The connecting rods and cross-heads being mostly hid in the representation, are so nearly in the common form as to need no description. But the feet of the said connecting rods are connected together by a moveable joint, so as to revolve round a centre-pin, which is removed from the centre round which the cylinders revolve, just half the length of the stroke of the pistons.

The steam is conducted through a hole lengthwise in the main axis G, and out through a hole in the side thereof into the bottom of each cylinder successively, as they revolve.

On the side of each cylinder is a tube, passing from the bottom to the top, and also connected at the bottom with that which lets the steam into the bottom of the opposite cylinder, so that when the steam is let into the bottom of one cylinder it enters the top of the one opposite ; and as the feet of the connecting rods revolve round a centre at some distance from the centre of the main axis, as the pistons act and re-act, the cylinders must of course revolve round the axis; and when each cylinder has passed round to the opposite side from whence it filled, the steam escapes through a hole on the opposite side of the axis into a hole lengthwise of the axis, and parallel to the one by which it entered, and goes off through the discharge pipe *i*.

Mr. F. will engage to construct an engine and boiler of fifty horse power, of strong and permanent workmanship, which (both engine and boiler) shall stand on a circle of six feet diameter, and will not vary much in weight from three tons. And operating with a steady rotary impulse and without any jar, its operation will be much pleasanter in steamboats, and also prevent the injury done to the boats by the constant racking motion of the engines now in use.

This engine and boiler will be in operation in a few days at 246 Water street, New-York.

Since the above was in type, we have received the following from Mr. Fairman :

To the Editor of the Mechanics' Magazine :

SIR,—However I may be reduced, by the misfortune, or rather the folly, of having undertaken to invent useful mechanical improvements, my pride is not so far overcome as to be willing to ask any services on the score of charity ; but if, from any other motive, you should see fit to give this a place in your Magazine, I wish you better remuneration for so doing than to meet the fate of an inventor.

I had long been led to believe that a *rotary* steam engine, simple, operative, and sure in its construction, with an efficient boiler, both so compact, and consequently light, as not to overburthen their own power, and peculiarly adapted to locomotive purposes, was a desideratum for which the enlighted public would liberally reward the inventor, if such an inventor could be found. I had good authority for so believing. Many respectable writers on the subject of steam

power, have noticed the importance of such an invention, but all I have seen have considered it impracticable.

Mr. Nicholson, in his Operative Mechanic, (Philadelphia edition, page 206,) says: "All steam engines, as yet noticed, have their action by the movement of a piston, in a cylinder, and act by what is called a reciprocating motion. In engines of this description a very considerable degree of power is expended in arresting the motion of the different working parts, and putting them into action in a contrary course. This has claimed much attention of engineers, and many attempts have been made to construct an engine in which the action of the steam should operate in a continuous manner, without bringing the parts to a state of rest."

Again he remarks, (page 213,) "The reciprocating motion in steam engines is a loss of power, which cannot be denied, for the momentum of the beam and other parts, passing in one direction, have suddenly to be arrested and moved in the opposite direction, which produces a loss of power.

"Rotary action has been sought, therefore, with propriety, but has not yet been attained with advantage."

Since Mr. Nicholson wrote the foregoing, the importance of locomotive steam powers has nearly doubled, and yet I have known of no attempt which was likely to succeed in effecting the desired object.

With these views of the subject, and believing, or at least hoping, it was practicable, I undertook, and have no hesitation in stating, that I have effected all that the subject required. I have constructed an engine and boiler as little liable to disorder, and as easily kept in repair, as any other, and, I believe, with at least double the power, in proportion both to the cost and weight, of any which has come to my knowledge.

But my want of pecuniary means compelled me to let the engine and boiler which formed the first experiment, and which could not be expected to be perfect, go out of my control, and be placed where, by awkward management, if it be not condemned, it will discredit rather than benefit the invention. No man of judgment would expect perfection in a first experiment; but fortunately there was no mistake perceived in the engine, and but for a slight miscalculation in the boiler, I would not wish my reputation to stand, as an inventor, on a better foundation.

I cannot now invest the necessary sum in materials to exhibit my invention to the public, but if any gentleman or company interested in procuring the best locomotive engine and boiler, after due examination of my plan, will furnish materials, I will hazard all the labor of constructing them at short notice, and will guarantee, as far as my labor goes, that they shall not vary essentially from the following calculations:

A boiler, which shall expose 160 feet of heating surface to the water, and shall possess sufficient strength to work steam under 100 lbs. pressure to the inch above the atmosphere, and which, of course, must produce a sufficiency of steam for a fifteen or sixteen horse power; an engine with 4 cylinders, 6 inches diameter, 18 inch stroke, making four double strokes at each revolution, and 50 to 60 revolutions per minute, working off from 78 to 94 feet of steam.

The whole engine, boiler and furnace, shall only occupy a circular space of three feet six inches diameter; and shall weigh less than a ton. A boiler and furnace sufficient for a fifty horse power shall stand on a circle six feet in diameter.

All which facts are respectfully submitted by the public's humble servant,

SIMON FAIRMAN.

P. S.—I have no wish nor reason to find any fault with the conduct of the gentleman in whose hands my steam engine is placed in New-York. I have found nothing ungentlemanly or unfair in his conduct. The only difficulty is, the engine was taken away prematurely. S. F.

History of Chemistry. [Concluded from page 279.]

OF BISMUTH.—Bismuth is of a reddish white color, and almost destitute both of taste and smell. It is composed of broad brilliant plates adhering to each other. The figure of its particles, according to Hauy, is an octahedron, or two four-sided pyramids, applied base to base.

Its specific gravity is 9·822; but when hammered cautiously, its density, as Muschenbroeck ascertained, is considerably increased. It is not, therefore, very brittle; it breaks, however, when struck smartly by a hammer, and consequently is not malleable. Neither can it be drawn out into wire. Its tenacity, from the trials of Muschenbroeck, appears to be such, that a rod one tenth of an inch in diameter is capable of sustaining a weight of nearly 29 lbs.

When heated to the temperature of 476° it melts; and if the heat be much increased it evaporates, and may be distilled over in close vessels. When allowed to cool slowly, and when the liquid metal is withdrawn, as soon as the surface congeals, it crystallizes in parallelopipeds, which cross each other at right angles.

When exposed to the air it soon loses its lustre, but scarcely undergoes any other change. It is not altered when kept under water.

Bismuth is alloyed with several metals, in order to give them hardness, rigidity, or consistence; it is particularly useful to the pewterers, and all those who employ white and hard alloys. It is generally believed that it acts upon the animal economy in the same manner as lead, though this opinion is yet supported by no decisive facts.

The utility of its oxides is very considerable. It is employed in this form by the manufacturers of porcelain in the preparation of some yellow enamels; it is mixed with other oxides, in order to tinge the color of glazes and paintings. It is sometimes used in the manufacture of colored glass, and to give a yellow tinge approaching to green. The white paint or focus made from the oxide of bismuth is often used by females to paint the face; but it injures the skin very much, and is converted to a black by sulphuretted hydrogen gas.

Of Antimony.—Antimony is of a greyish white color, and has a good deal of brilliancy. Its texture is laminated, and exhibits plates crossing each other in every direction, and sometimes assuming the appearance of imperfect crystals. Hauy has with great labor ascertained that the primitive form of these crystals is an octahedron, and that the integrant particles of antimony have the figure of tetrahedrons.

When rubbed upon the fingers, it communicates to them a peculiar taste and smell.

Its specific gravity is, according to Brisson, 6·702; according to Bergman, 6·86. Hatchett found it 6·712.

It is very brittle, and may be easily reduced in a mortar to a fine powder. Its tenacity, from the experiments of Muschenbroeck, appears to be such, that a rod of one tenth of an inch in diameter is capable of supporting about 10 pounds weight.

When heated to 810° Fahrenheit, or just to redness, it melts. If after this the heat be increased, the metal evaporates.

Antimony is the base of the alloy which is employed for casting printing types, to which it communicates hardness. It is often made to enter, with lead and tin, into rigid hard alloys, which are very useful for a variety of purposes. The oxide of antimony is used in the fabrication of colored glass, enamels, the glazing and painting upon porcelain; it is the basis of the yellow, brownish, and orange colors, which resemble the amethyst. It is mixed with several other oxides in order to produce a great variety of colors, the effects of which have been observed, but their causes have not yet been explained.

Of Manganese.—Manganese is distinguished from all other metals by the following properties. It is of a brilliant whiteness, approaching to grey, which is quickly altered in the air; its texture is granulated, without being so fine and close as that of cobalt; its fracture is rough and unequal; its specific gravity is 6·850; it holds, together with iron, the first rank in the order of hardness; it is one of the most brittle metals; at the same time it is one of the most difficult to be fused. Guyton places it immediately after platina, and determines it at the 160th degree of Wedgwood's pyrometer. We know neither its dilatability by caloric, nor its conducting property. It is frequently susceptible of being attracted by the loadstone, especially when it is in a state of powder, on account of the iron which it contains, and which is almost as difficult to be separated from it as from nickel; it has no perceptible smell nor taste; in communication with other metals, it exerts the galvanic action upon the nervous and muscular systems of animals; its color is extremely variable.

Only one ore of manganese is as yet well known, namely, its native oxide, which some modern mineralogists, amongst others Mr. Kirwan, announced as being combined with carbonic acid. This oxide is frequently mixed with iron, barytes, silex, lime, &c.; it varies also by its state of oxidation, or by the proportion of oxygen which it contains.

The ores of manganese are not worked in the large way, not merely on account of the refractory nature of these ores, but more especially because it is of no utility in its metallic state. The places where the native oxide of manganese is found are merely worked in order to furnish the manufactories of glass, bleaching, &c. with this oxide, which is employed in them.

Of Cobalt.—The ores of cobalt have been used in different parts of Europe since the beginning of the 16th century, to tinge glass of a blue color. But the nature of cobalt was altogether unknown till it was examined by Brandt, in 1733. This celebrated Swedish chemist obtained from it a new metal, to which he gave the name of cobalt. Lehmann published a very full account of every thing relating to this metal in 1761.

Cobalt is of a grey color, with a shade of red, and by no means brilliant. Its texture varies according to the heat employed in fusing it. Sometimes it is composed of plates, sometimes of grains, and sometimes

of small fibres adhering to each other. It has scarcely any taste or smell.

Its specific gravity, according to Bergman, and the School of Mines at Paris, is 7·7. Mr. Hatchet found a specimen of 7·645.

It is brittle, and easily reduced to powder; but, if we believe Leonhardi, it is somewhat malleable when red hot. Its tenacity is unknown. When heated to the temperature of 130° Wedgwood, it melts, but no heat which we can produce is sufficient to cause it to evaporate. When cooled slowly in a crucible, if the vessel be inclined the moment the surface of the metal congeals, it may be obtained crystallized in irregular prisms.

Like iron, it is attracted by the magnet; and, from the experiments of Wenzel, it appears that it may be converted into a magnet precisely similar in its properties to the common magnetic needle.

Cobalt is not used in its metallic form; but it is much employed to make blue glasses or enamels. In the manufactories of porcelain, much care is taken to have the oxides of cobalt very pure and attenuated. The grey ore is chosen well crystallized; this is roasted, and treated with the nitric or muriatic acid, or otherwise it is burned with nitrate of potash; the oxide is carefully washed with much water, by which treatment the oxide is obtained in violet-colored powder, very fine, and very homogeneous, which affords the purest and most beautiful blue when treated with a vitreous flux. The elegant blue of the porcelain of Sevres is of this nature.

Of Tellurium.—In the year 1797, Mr. Klaproth, of Berlin, discovered a brittle whitish metal among the ores of gold brought from the mountains of Transylvania, to which he gave the name of *Tellurium*.

Pure tellurium is of a tin-white color, verging to lead-grey, with a high metallic lustre, of a foliated fracture, and very brittle, so as to be easily pulverized. Its specific gravity is 6·115; it melts before ignition, requiring a little higher heat than lead, and less than antimony; and according to Gmelin, is as volatile as arsenic. When cooled without agitation, its surface has a crystallized appearance. Before the blow-pipe on charcoal, it burns with a vivid blue light, greenish on the edges, and is dissipated in greyish white vapors of a pungent smell, which condense into a white oxide. This oxide, heated on charcoal, is reduced with a kind of explosion, and soon again volatilized. Heated in a glass retort, it fuses into a straw-colored striated mass. It appears to contain about 16 per cent. of oxygen.

Nothing decisive can yet be said concerning the uses of this metal, on account of its scarcity and its recent discovery. But should it be found in other ores, as well as in those of Transylvania, it may become of great utility in the arts, as appears from its extreme fusibility, and its slight adhesion to ogygen.

Of Arsenic.—From the earliest period in which mankind worked the metallic ores, they must have ascertained the volatility, the odor, and the obnoxious effects of arsenic. Nevertheless, it remained unknown as a metal, and was not placed among the semi-metals, or brittle metallic bodies, till the beginning of the 18th century, when Paracelsus announced that it might be obtained white in the metallic form. Schroeder, in 1649, mentioned a metal extracted from orpiment and arsenic; and Lemery, in 1675, described a process which is at present used with success in the mixture of fixed alkali and soap with this oxide, to obtain what is called the regulus. The ancients were acquainted with its oxide, its yellow and red sulphuret, under the name of arsenic, sandarach, and orpiment. Mineralogists were for a long time content to range it among sulphurous matters, and considered it only as a mineralizer of the metals. Brandt, in 1733, and Macquer, in 1746, showed that it is a true metal, possessing properties highly characteristic, and different from those of every other metal.

Arsenic has a blueish white color, not unlike that of steel, and a good deal of brilliancy. It has no sensible smell while cold; but when heated, it emits a strong odor of garlic, which is very characteristic.

Its specific gravity is 8·31.

It is perhaps the most brittle of all the metals, falling to pieces under a very moderate blow of a hammer, and admitting of being easily reduced to a very fine powder in a mortar.

Its fusing point is not known, because it is the most volatile of the metals, subliming without melting when exposed in close vessels to a heat of 356°.

Arsenic, in the metallic form, is but little employed, except in chemical laboratories, where various experiments, researches, and demonstrations are carried on.

As it is sometimes employed for killing flies, great caution should be used in applying it to this purpose; for this substance, which is sold under the name of testaceous cobalt, or fly powder, is very dangerous to animals of every description.

In some manufactories it is alloyed with various metals, in order to whiten and harden

them; the white copper is frequently an alloy of this kind. But though such alloys may be of use in some cases, they ought never to be employed for the preparation of food, drinks, or medicines.

Of Chromium.—The analysis of a mineral made by other means, and with more care than hitherto had been applied to its examination, presented in December, 1797, to Vauquelin, the discovery of this metal. It is of a white color, inclining to grey, very hard, brittle, and extremely difficult of fusion. The small quantity which Vauquelin could procure did not permit him to ascertain many of its properties. It is but little altered by exposure to heat, and probably would be affected neither by the action of air nor of water. Acids act upon it but slowly; nitric acid gradually converts it into an oxide by communicating oxygen.

It is hardly to be supposed that a metal so recently discovered can have yet been applied to any use. However, Vauquelin has already observed that its oxide may be used in the fabrication of glass and enamel; and it may even, perhaps, have been already employed, without suspecting it, in the mixtures of the products of minerals ill understood or analyzed, of which it may form a part.

Of Molybdenum.—The name of molybdena, which was formerly synonymous with that of plumbago, or black lead, or the natural combination of iron and charcoal, or carburet of iron, is at present given to a brittle and acidifiable metal, of which the ore was confounded with that coally substance. Many considered them as one and the same substance, and they were sold under the same denomination, till Scheele, in 1778, published in the volumes of the Stockholm Academy a memoir, in which he showed that the substance called molybdena is very different from the carburet of iron, and contains a combination of sulphur, with a substance which he took for a peculiar acid.

Hitherto molybdenum has only been obtained in small agglutinated metallic grains; the greatest heat of our furnaces not being sufficient to melt it into a button. Hence we are but imperfectly acquainted with its properties.

The specimens produced by Hielm were of a yellowish white color, and internally greenish white.

Its specific gravity he found as high as 7·400. From his experiments, compared with those of Klaproth and Buckolz, on uranium, it seems probable that molybdenum is even more refractory than that metal.

When exposed to heat in an open vessel, it gradually combines with oxygen, and is converted into a white oxide, which is volatilized in small brilliant needle-form crystals. This oxide having the properties of an acid, is known by the name of *molybdic acid.*

Of Tungsten.—The name Tungsten, which signifies heavy stone, was given by the Swedes to a mineral which Scheele found to contain a peculiar metal, as he supposed, in the state of an acid, united with lime. The same metallic substance was afterwards found by Don d'Elhuyart, united with iron and manganese in wolfram.

Tungsten is of a greyish white color, or rather like that of iron, and has a good deal of brilliancy.

It is one of the hardest of the metals; for Vauquelin and Hecht could scarcely make any impression upon it with a file. It seems also to be brittle. Its specific gravity, according to the d'Elhuyarts, is 17·6; according to Allen and Aiken, 17·22. It is therefore the heaviest of the metals after gold and platinum.

It requires for fusion a temperature at least equal to 170° Wedgwood. It seems to have the property of crystallizing on cooling, like all the other metals; for the imperfect button procured by Vauquelin and Hecht contained a great number of small crystals.

Nothing has yet been observed respecting the uses of a metal so little known or examined as tungsten. No trial has yet been made with regard to its useful properties; and it is to be feared, that its reduction and fusion being difficult, will render it so intractable as not to be used but with great difficulty.

Of Columbium.—This metal was discovered by Mr. Hatchett, in a mineral belonging to the cabinet of the British Museum, supposed to be brought from Massachusetts, in North America.

Its lustre was glassy, and in some parts slightly metallic. It was moderately hard, but very brittle. By trituration it yielded a powder of a dark chocolate brown, not attracted by the magnet. Its specific gravity, at the temperature of 65°, was 5·918.

Of Selenium.—In 1819, M. Berzelius extracted a new elementary body from the pyrites Fahlun, which, from its chemical properties, he places between sulphur and tellurium, though it has more properties in common with the former than with the latter substance. It was obtained in exceedingly small quantity from a large portion of pyrites.

When it is fused it becomes solid, its surface assumes a metallic brilliancy of a deep

brown color. Its fracture is conchoidal, vitreous, of the color of lead, and perfectly metallic.

Of Osmium.—This singular metal was discovered by Mr. Tennant, about the year 1804, in the ore of platina, combined with another metallic substance, which received the name of Iridium.

Osmium has a dark grey or blue color, and the metallic lustre. When heated in the open air it evaporates with the usual smell; but in close vessels, when the oxidizement is prevented, it does not appear in the least volatile. When subjected to a strong white heat in a charcoal crucible, it does not melt nor undergo any apparent alteration. It is not acted upon by any acid, not even the nitro-muriatic, after exposure to heat; but when heated with potash, it combines with that alkali, and forms with it an orange yellow solution.

Of Rhodium.—This metal is of a white color. Its specific gravity seems somewhat to exceed 11. No degree of heat hitherto applied is capable of fusing it. It is, therefore, uncertain whether it be malleable; but as it forms malleable alloys with the other metals, it is probable that it would not be destitute of malleability, if it could be fused into a button.

Of Iridium.—This metal was discovered by Mr. Smithson Tennant in 1803, in the ore of crude platina.

The iridium which was thus obtained was white, and could not be melted by any heat Mr. Tennant could employ. Vauquelin considers it as brittle, and as even occasioning the brittleness of platinum; but as it has not been obtained in a metallic button, and as it forms malleable alloys with all metals tried, that property does not seem to be sufficiently decided. It resists the action of all acids, even the nitro-muriatic acid.

Of Uranium.—This metal was discovered by Klaproth in a mineral which contains uranium combined with sulphur.

By treating the ores of the metal with the nitric or nitro-muriatic acid, the oxide will be dissolved, and may be precipitated by the addition of a caustic alkali. It is insoluble in water, and of a yellow color; but a strong heat renders it of a brownish grey.

Of Titanium.—Titanium is obtained from a mineral found in Hungary, called red schorl, or titanite; and also in a substance from the valley of Menachan, in Cornwall, termed menachanite. It was in the latter substance that it was originally discovered by Mr. Gregor, of Cornwall; and its characters have since been more fully investigated by Klaproth, Vauquelin, Hecht, Lovitz, and Lampadius.

Its color is that of copper, but deeper. It has considerable lustre. It is brittle, but in thin plates has considerable elasticity. It is highly infusible.

When exposed to the air it tarnishes, and is easily oxidized by heat, assuming a blue color. It detonates when thrown into red hot nitre.

Of Cerium.—Cerium was discovered by Messrs. Berzelius and Hisenger, of Stockholm, in a mineral from Bastreas, in Sweden, to which they gave the name of Cerit, and which had been for some time before supposed to be an ore of tungsten. This discovery has since been confirmed by the experiments of Vauquelin.

Of Wodanium.—This is a new metal, recently discovered by Lampadius in the mineral called *Woodan Pyrites*. This metal has a bronze-yellow color, similar to that of cobalt glance, and its specific gravity is 11·470. It is malleable; its fracture is hackly; it has the hardness of fluor spar; and is strongly attracted by the magnet.

It is not tarnished by exposure to the atmosphere at the common temperature; but when heated, it is converted into a black oxide.

Alkaline and Earthy Metals.—The remaining substances contained in the table of metal, at page 37, are the bases of the two fixed alkalies, (potash and soda,) and of the eleven substances at present considered as earths.

The two first, potassium and sodium, as well as barium, and a few of the others, were obtained by Sir H. Davy, by decomposing the alkalies and earths by galvanic electricity; whilst the others are *merely* considered as the metallic bases of the respective earths whose names they bear.

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 327.)

Here we find a very beautiful muscular apparatus which is necessary to the perfect adjustment of these cords. The cords are attached to small muscles called *columnæ carneæ*, C C, or fleshy columns, which at their other extremities are incorporated with the muscular wall of the ventricle itself. The use of these muscles is now to be explained. Had the tendinous cords of the valves been tied to the inside of the wall of the ventricle, without the intervention of these muscles, as the walls of the cavity approach each other during their con-

traction, the tendinous cords would have been let loose, and the margins of the valves carried back into the auricle. But, by the intervention of these muscles, they are pulled upon and shortened in proportion as the sides of the cavity approach each other.

On the whole, then, we perceive that this apparatus, which is as intricate as the rigging of a ship, consists of a variety of fleshy columns and cords, many of which, in fact, run across the cavity of the ventricle.

We are about to exhibit another form of a valve, much simpler, and yet we are bound to believe equally effectual; which tends to support the opinion expressed above, that besides preventing the retrograde motion of the blood, this intricate apparatus of the ventricle is intended more effectually to agitate and to mix the different streams.

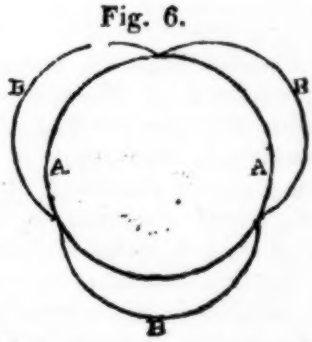
At the root or origin of the great artery, called the *Aorta*, there is a firm ring, to which the valves now to be described are attached. The necessity of this will appear evident, since, if the ring could be stretched by the force of the heart's action, the valves or flood-gates would not be sufficient to close the passage; their conjoined diameters would not equal that of the artery which they have to close. These valves are three in number: they are little half-moon shaped bags of thin membrane, which are thrown up by the blood passing out from the ventricle, but by the slightest retrograde movement of the blood, their margins are caught, and then, being distended or bagged, they fall together and close the passage. There are some curious little adjuncts to these valves, which ought to be explained, as shewing the accuracy of the mechanical provision.

When the margin of the valve is thrown up by the blood passing out of the heart, it is not permitted to touch or fall flat upon the

Fig. 5.

side of the artery, for, if it did, it would not be readily caught up by the blood that flows back; there is, therefore, a little dilatation of the coats of the artery behind each valve, by which, although the margins of the valve be distended to the full circle, they never cling to the coats. These valves, then, are never permitted to fall against the coats of the artery, and therefore they are always prepared to receive the motion of the refluent blood.

Fig. 6.



Let this figure represent a transverse section of the root of the aorta: A A, the inner circle, is the margin of the three valves thrown up to let the blood pass. B B B are three semi-circular bags, formed by the dilatation of the coats of the artery at this part, receding from the margin of each of the valves—consequently, in such a manner as to leave a space between the valves and the sides of the vessel.

To strengthen the valves, a tendon runs along their margin, like the bolt-rope or foot-rope along the edge of a sail, and these ligaments are attached to the side of the artery, and give the valve great strength.

Fig. 7.

These valves, we have said, are semilunar, consequently, when they fall together there must be a space, A, left between them. If we put the points of the thumb, fore and middle fingers, together, there is a triangular space left between them; such a space between the convexities of the three valves would be a defect.

Fig. 8.

This figure represents the artery open, and the semi-circular valves, like little bags, attached to the inside.

Three little bodies like tongues are therefore attached to the middle of the margin of each valve, and these, falling together when the valve is shut down, perfect the septum and prevent a drop of blood passing backwards.

---

*Effect of Combinations on the Introduction and Improvement of Machinery.** [From the London Mechanics' Magazine.]

As hostility to machinery is a very prevalent feeling among the working classes, it might be supposed that they would turn all the power of their Unions towards its suppression. In this attempt, however, they have been singularly unsuccessful; and so far have they been from attaining, or even approaching the attainment of this object, that their efforts have led to an actually contrary result, and some of the most valuable and ingenious machines that our manufactories can boast of, actually owe their existence to the operation of Trades' Unions.

The cotton trade affords one remarkable instance of the truth of this observation. The evils inflicted on this manufacture by strikes have been detailed; many years ago the masters, with the view of escaping these disastrous effects of the tyranny of the Spinners' Union, requested the machine makers to attempt the construction of a self-acting mule, that is, of a mule which should perform its work without the assistance of a spinner. For a long time the attempt was regarded as hopeless: difficulties stood in the way, which it is not easy to describe, requiring, however, all the resources of mechanical genius to surmount. But the successive efforts of mechanists have by degrees overcome every obstacle, and the skill of Mr. Roberts, an eminent machine maker, at Manchester, has brought the invention to perfection. The most extraordinany power of this machine consists in its manner of regulating the motion of the spindles, when the mule is receding to its frame; during this retrograde course, which carries the mule over the space of 4¼ feet, about three times a minute, the velocity of the spindles is constantly changing, and this continues as many hours as they are filling with thread; they exhibit, to speak mathematically, a *fluxion* of movement: during no two successive portions of time, however small, is the speed the same. The machine may now be seen in action in several mills, and almost appears to realise the finest results that could be expected from human ingenuity.

The following evidence taken by the Committee of Manufactures and Commerce, which sat last session, will show the way in which the combination of the spinners is forcing the adoption of this machine. It is given by Mr. Graham, a Scotch manufacturer:

"We are paying much higher in Glasgow than they are paying in England for spinning the same numbers, and in consequence of this we have been driven to employ machines, which may supersede those men (spinners).

"Are you aware of any cotton-spinning work, where the proprietors are turning out the old machinery in consequence of the combination of the workmen, and introducing self-acting mules?—We are doing it ourselves.

"Have you adopted the self-acting mule to get rid of combinations?—Before adopting the self-acting mule, I had the plans drawn, and I called a deputation from the men in, and explained it to them, and I said, 'you drive us either to take machines, or you drive us to bankruptcy, or to stop our works; here is an order going off to Manchester for self-acting mules; we do not wish to introduce them, and we will be the last house to introduce them, if you will take the same wages that they have in Lancashire;' and they said 'It is no use, we are determined not to reduce our wages.'"

The introduction of this invention will eventually give a death-blow to the Spinners' Union, the members of which will have to thank themselves alone for the creation of this destined agent of their extinction. It is now rapidly coming into use; other advantages, besides the great one of escaping from the dictation of the workmen, are found to attend it; and in a few years the very name of working-spinners, as well as the follies and oppression of their combination, will only be found in history.

The turn-out of the Lancashire workmen in the building trade has introduced a curious application of the steam engine. This machine is now employed in some towns, instead of manual labor, in hoisting the various building materials to the top of the edifice, where they are intended to be used. The magnificent design of the Liverpool custom-house is at the present moment rising into existence by the assistance of steam. The following letter from a master builder,

---

* From a very interesting pamphlet just published by Messrs. Ridgway, entitled "Character, Objeet, and Effects, of Trade Unions," written for the purpose of demonstrating the injurious tendency of these Unions, and written, it must be confessed, with great ability; but which, it is only fair to add, contains many facts of very questionable authenticity, and calls for new laws to put down a class of associations, which, if all be true that the author asserts of them, may be safely left to work out their own downfall.

who was one of the principal sufferers in this strike, graphically describes the circumstances attending the introduction of the improvement:

"Sir,—I have much pleasure in complying with your request, and shall feel happy if any information, which I can afford, will be useful to your purpose. About two years ago, the bricklayers' laborers, whom I had at work at the new custom-house here, began to exhibit symptoms of rebellion, the building being unusually large, and requiring much work. I found that just in proportion as we were hurried, the laborers began to relax and grow careless, and sometimes did not do a sufficient quantity of work to cover their own wages. My wits were accordingly set to work to discover a remedy. I well knew that if I resorted to severe measures, a general strike would have been the consequence; but as we had on the ground, about 35 yards from the front of the edifice, a seven-horse steam engine, for the purpose of mixing up our lime and sand into mortar, and making grout, I had the shaft of the mill lengthened, and a drum fixed upon it; attached to this was a chain governed by a break, which we carried in a hollow trough under ground, and connected with a cross-beam placed upon two uprights on the top of the building. We then placed 300 bricks in a square box, slung it, and tried our engine. The bricks went up in fine style, and were received at the top by waggons placed on a light railway, furnished with cross slides, and the result was that two laborers could fill the boxes with bricks below, sling them on the chain, and two more receive them at the top, who, by the help of the railway, conveyed them (weighing 23 cwt.) to any part of the building with ease. We thus rendered useless the services of about 20 hod-carriers at once, at the cost of about £100 in machinery. The remainder of the men were for a long period quiet, and would have continued so, had not the Trades' Unions virtually compelled them to strike, many of them against their wills. The contrivance just mentioned has acted so well, that when in full work we usually send to the top of the building 16,000 bricks per diem, with 7 or 8 tons of mortar and grout, the engine all the while doing its other accustomed work. This would only pay in large buildings; in small erections the expense of fixing the machinery would be too great; but small high pressure steam engines are now made, which stand upon three feet square, consume about 1 cwt. of coal a day, and will hoist with sufficient rapidity 25 cwt. to any height, —they are also sufficiently portable to be moved about in small carts; or I am satisfied that a horse with a rope and pulley, working through a snatch block, would be cheaper and better than the old system of manual labor.

"The contractor for the stone work at the new custom-house raises all his materials by a small engine, (I think it is eight-horse power,) which cost him £150, and his other additional machinery about £200 more. He sends his stones (varying from 1 to 11 tons in weight) up to the summit with perfect ease. His engine, like ours, is stationary, and his ropes run round the building to that part where the work is proceeding; and though they are sometimes 500 feet in length, no difficulty is experienced from this cause. We send up indiscriminately, bricks, stone, iron, or timber; the engine is much more tractable and civil than the hod-men, easier managed, keeps good hours, drinks no whiskey, and is never tired. I need hardly add, that in a large building it is much cheaper, more expeditious and satisfactory, than carrying up materials on men's shoulders. The time consumed by the men in *descending*, and by the slowness of their ascent consequent on the loss of strength caused by having to overcome the gravity of their own bodies before they have strength to spare for carrying a heavy burden, makes the hod-carriers far inferior to the steam engine, more especially if we consider the constancy with which the latter works. I do not now fear a turn-out of hod-carriers, because I have proved that we can do very well without them, and I think that I now see many other modes of saving labor, which I should instantly avail myself of, were another strike to happen amongst my workmen. It is also obvious to myself, that many of the uses to which machinery is now applied may be traced to turn-outs, which, having subjected masters to inconveniences, have compelled them to scheme mechanical contrivances that otherwise would not have been thought of. Feeling that improvements in mechanism will not eventually injure the laborer, yet I would not hastily adopt such as would suddenly deprive a number of men of their subsistence, did not their own folly compel them to it. I am now quite sure that another strike or two will annihilate many hod-carriers, and brick-makers, and this principle of hoisting by stationary or moveable steam engines will no doubt be adopted for many other purposes, if the operatives in different departments endeavor to force their employers to pay a higher rate of wages than they can afford. For instance, we know that two stationary engines

at each dock, with shafts and drums running along the quays, would discharge the cargoes of all the ships, with a tenth of the porters now employed; at present I should be sorry to see it adopted, but I know before long it must be done.

"I am, sir, your very faithful servant,
"SAMUEL HOLME.
"Liverpool, Feb. 7, 1834."

The machine lately introduced in the wool-combing business has also been alluded to; the history of its invention gives, in a short compass, a view of the process by which results of this kind are brought about. The Wool-combers' Union has been celebrated above a century, and several acts of Parliament have been passed with the object of suppressing the power which it had acquired, and exercised with the usual bad consequences. Hence, many endeavors have been made to comb wool entirely by machinery, but with very partial success, till last year, when the whole of the combers in a large factory struck, upon which the proprietors turned their attention to this machine, applied their skill and capital to its improvement, and in a short time brought it to such perfection, as completely to supersede the employment of wool-combers.* It consists of two large wheels, set with spikes, and which are made to approach and recede alternately from each other; the spokes, fellies, and axles, are all hollow, by means of which steam is kept constantly flowing through every part of the machine, like the arteries in the human body, diffusing the required warmth to every corner of the engine. This invention is now daily coming into wider use; it performs its work both better and cheaper than by the old process, and before no long period has elapsed, the trade of wool-comber, like that of cotton-spinner, will cease to exist.

Mr. Babbage, in his "Economy of Manufactures," has given two other instances of invention of modes for superseding human labor, owing to strikes among workmen; one occurred in the manufacture of gun-barrels, and the other in that of iron tubes in general; and doubtless many other cases might be found, in which a similar process had taken place.

The obvious result of this forced and premature adoption of new machinery is to displace labor with inconvenient rapidity, and instead of improvement proceeding by those gently varying gradations, which characterise its natural progress, it advances, as it were, *per saltum*, and comes upon the workman unprepared for the change which his course of life must subsequently undergo. The counter effect in retarding the improvement of machinery, sometimes caused by combinations, is so trivial as hardly to deserve mention. But whatever power they may have in this way, the end of it must be to increase still further the evil just alluded to, and to make the progress in the application of substitutes for labor more fluctuating and irregular. At one time they are unnaturally held back, at another pushed forward.

It would be a glaring absurdity to suppose that the improvement of machinery can be really hurtful to society, or lessen the demand for labor in the country which employs it, when we have the example of Manchester before us, where, within a radius of forty miles, more human beings are collected together, and substitutes for labor more extensively used, than on any other spot on earth, and where, in addition, wages are for the most part enormously high. It undoubtedly is productive of transient injury, by the displacement which it causes of manual labor in those operations to which it is applied. But this evil is trivial, if the displacement be slow, and is formidable only when it is pushed on, as in the case above mentioned, with sudden violence.

We might view these inventions with unmixed pleasure, on account of their use to society, and even—considering the force of example—without much regret for the retribution they inflict on the offenders, were it possible to put out of sight some of the evils which may for a season follow their introduction. The community certainly gains by such mechanical improvements, which, since they spring from hostility to combinations, may be considered as indirect effects of them, and form, as far as we are aware, the only benefits those bodies have bestowed upon their country, in return for the violence and oppression of which they have been guilty.

NEW BOOT-JACKS.—A London manufacturer, amongst many articles enumerated for sale, announces "VESTRIS' BOOT-JACKS, made in *imitation of Madame V.'s leg.*" ! ! ! A *boot-jack* in imitation of a *Lady's leg!* Can none of our fancy dealers import it (the boot-jack)? We have a strange curiosity to see it.

* Till within a few years of the time when this machine was introduced, it could not have been made, though it might have been imagined, and every part and principle necessary to its construction clearly and accurately described. The reason is, that the skill and nicety of execution necessary to the manufacturing of such a machine, or of any machine requiring delicate adjustments, did not exist. The principle of Bramah's press was known two centuries before its application, but was a barren truth till mechanism had advanced sufficiently to give it an existence. [See Babbage on the Decline of Science.]

On a General Mean of computing Descriptive Data of Ellipsoidal Arches, with a new Theorem, and Mechanical Description of their Working Drafts.

To the Editor, &c.

SIR,—I am induced to send for the Journal the following theorem, and incidental observations, relating to the means of describing the working drafts of ellipsoidal arches, in consequence of the solution of that problem having frequently occupied the attention of the scientific engineer, and still being, I conceive, a desideratum: at least, *general* expressions possessing the simplicity desirable and even requisite for practical purposes, and furnishing rigorous results, have not yet been investigated for obtaining the pre-requisites to the description of this curve—which is perhaps the most useful and important of any which are used in the whole range of arcuation.

Although the problem is well known to be susceptible of rigorous solution, the length of the process of computation has been deemed so formidable as to induce its supersedure by mechanical processes: the distinguished Corps de Ponts et Chaussees recommend a graphic solution. This solution is objectionable from its obvious want of rigor—a sufficient objection, I apprehend, when it is considered that, in far the greater number of instances, does this curve find its application to structures involving an expenditure of thousands, and having their elegance and *stability* materially affected thereby. The process which they would have chosen in the computation, it would seem, was, and must have been, quite formidable, to have induced this justly eminent Corps to recommend this course; but with the assistance of the theorem I am about to advance, a perfect estimation of all the pre-requisites for the description of this curve, for the greatest number of centres desirable in practice, and for arches of the largest dimensions, may be achieved in a lapse of an hour or two—an interval of time which I fancy the practical engineer will admit it is often necessary to exceed in the adjustment of much more trivial matters.

The peculiar appositeness of the semi-ellipsis, both in regard to equilibration and feasibility, when compared with the full centre, or its segment, or that of the ellipsis, as well as its elegance, will secure its adoption in preference in arches of considerable span, which are not liable to the condition of sustaining much pressure at the crown, or whose situation is not peculiarly favored by nature, at most of the localities which fall within the province of the civil engineer; for, in many places, the full centre, apart from its weakness, is absolutely inadmissible; and the segment of a circle can seldom be fortified with abutments sufficiently strong and massive to resist its stupendous thrust.

The ellipsoidal arch, or l'anse de panier, which answers the conditions of the ellipsis, has superseded it, and derives its importance chiefly from the fact of its mechanical description being executed with great ease, and because it presents a ready mode of making the drafts for the voussures—of which it is a rigorous condition that the joints be normal to the curve.

It may perhaps be unnecessary to give a demonstration in detail: the mathematical reader, with the aid of a diagram, will readily comprehend and trace its successive steps. To avoid indetermination, it is however a necessary condition, that the transverse axis be the locus of the centre of the least arc, and the prolongation of the semi-conjugate be the locus of the centre of the greatest arc; that the distances from these two centres to the common centre bear a given ratio, as $\frac{m}{n}$; that the subdivisions of these two lines, made by the intersections of the radii and their prolongations, bear, among themselves, a given ratio. It has further been conventionally determined that, in general, the subdivisions of m be in the ratio of the natural numbers 1, 2, 3, 4, &c., commencing at the least arc, and those of n be equal among themselves.

Let the subdivisions, or rather intersections, of m, by the radii, commencing with the least arc, be designated by b, c, d, &c., then the proposition is,—to find upon the tranverse axis the position of the point b.

If the vertex be taken as the origin, the general equation of the abscissa for b will be

$$x = \frac{\lambda \,.\, m - \gamma \,.\, (S - n)}{\gamma - \lambda} \quad . \quad . \quad . \quad (1.)$$

in which, x = abscissa; λ = semi-minor axis; γ = semi-major axis; and S = sum of the sides of the polygon formed by lines joining the centres, b, C, D, E, &c.

It is plain, from inspection, that when S is known, the whole may be considered as known. *The quantity* S *is that which it has been proposed to eliminate by construction, on account of the length and tedium of the process of computation.*

If, however, b', c', d', e', &c., represent the lesser angles formed at b, c, d, e, &c., by the radii of curvature with m, and C', D', E', F', &c., be the angular values of each sector at C, D, E, F, &c., which are equal to the differences of the former set of angles, taken in order, then I affirm that, in general, the subsequent theorem is true, viz.

$$S = \frac{1 \cdot \sin. c'}{\text{Sin. } C'} - \frac{1 \cdot \sin. b'}{\sin. C'} + \frac{2 \cdot \sin. d'}{\sin. D'} - \frac{2 \cdot \sin. c'}{\sin. D'} +$$

$$\frac{3 \cdot \sin. e'}{\sin. E'} - \frac{3 \cdot \sin. d'}{\sin. E'} + \frac{4 \cdot \sin. f'}{\sin. F'} - \frac{4 . \sin. e'}{\sin. F'} +$$

$$\frac{5 \cdot \sin. g'}{\sin. G'}, \text{ \&c.} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

An expression which, following a plain mathematical law, might obviously be extended, by inspection, to resolve S for an indefinite number of centres. It is a remarkable feature of this expression, that the law which it obeys

is so simple and obvious as to be easily retained by the memory, and consequently the operator has only to write it out and apply the tables at any time occasion may require its application.

It is thus observable that the 1st term $=$ S, for 3 centres; the algebraic sum of the 3 first terms $=$ S, for 5 centres; of the 5 first terms $=$ S, for 7 centres; and, in general, if $\nu =$ number of centres, $(\nu - 2)$ terms $=$ S.

Also, if R 1, R 2, R 3, &c. be the radii of each sector respectively, then $x = \text{R } 1, =$ least radius; $x + 1$ term $=$ R 2; $x + 3$ terms $=$ R 3; . . . . . $x + (\nu - 2)$ terms $= x + \text{S} = \text{R} \frac{(\nu+1)}{2} =$ greatest radius of curvature. It is possible to construct the curve without knowing any radius but the greatest; but they, as well as the *negative terms taken separately*, will be found serviceable, as checks, in fixing the position of the centres, and are estimated without any additional trouble; since being parts of S, it is only necessary to preserve the results of the separate terms in order to obtain them. Thus does a single simple expression afford *all* the data for tracing this important curve.

Although *speculatively* the expression might be simplified, in bringing the pairs of adjacent terms affected by contrary signs, to a common denominator, yet it would not be *practically* so, for it would not then be united to logarithmic computation, for which operation it has now the most convenient form. If the calculation be skilfully conducted, its valuation will be found brief and comprehensive. For eleven centres, the logs. of all the angles may be found by 10 references to the tables; and if the arithmetic complements of the logs. of their differences be taken, as also the logs. of 1, 2, ... 5, the simple addition of these logs. agreeably to the prescribed formula, with the summing of the natural numbers answering thereto, will be the only subsequent operations.

Thus, if the span of arch be 120 feet, its rise 40 feet, the numbers of centres 11, and it be determined that the ratio $\frac{m}{n} = \frac{1}{3}$, then will the position of b be indicated by the division of the semi-span in the ratio 15 : 18.71, or at 26.7 feet from the common centre; and $\text{R}\frac{(\nu+1)}{2} = 120$ feet $=$ span.

Whence it is inferable, that the anse de panier of 11 centres, having the ratios $\frac{m}{n}$ and $\frac{\lambda}{2\gamma}$ each $= \frac{1}{3}$, *has its greatest radius equal to the span, or that* $\text{R}\frac{(\nu-1)}{2} = 2\lambda$; *and thence may it be constructed without any calculation, simply from the known span and rise.*

Its Mechanical Description.—It has not, hitherto, I believe, been remarked that the anse de panier is an *involute*, the evolute of which and locus of the centres of curvature is the polygon b, C, D, E, &c., and x the radius of curvature for the vertex. Hence, the most elegant, ready, and perhaps the best, mode of describing it mechanically, after the requisite lines have been obtained as above, is,—to fix firmly, in the plane of the draft, pins at the vertices, and at each of the central points, upon either side of n, to attach a small but firm flexible wire to the centre lying upon the conjugate produced. After plying it about the polygon to b, and increasing its length by x, which will extend it to the vertex—its evolvement will trace one half. In plying the wire upon the polygon lying upon the other side of n, the other half may be traced.

Or, take the wire $= \text{R}\frac{(\nu+1)}{2}$, and sweeping from the crown, ply the wire about the polygon as before, for one half; returning to the crown, ply it about the symmetrical polygon on the other side of n, for the other half.

As the wire in these movements is always in the direction of the radius of curvature, or the normal, the joints are readily constructed in this mode of description.

Very respectfully,
W. M. Cushman, C. E.

Albany, May 29, 1834.

On the Probable Results of Railroads, &c.

To the Editor of the American Railroad Journal, and Advocate of Internal Improvements.

Sir,—Has it never occurred to you that the capital vested in many railroads and canals is likely, if not exceedingly profitable at the commencement, to be eventually lost, from the roads and canals being superseded by others which may be made afterwards. The great and ultimate object of these improvements is to facilitate exchanges—to cheapen and expedite transportation to and from market—as, between the great coal region, or between the great agricultural west and the best market, whether Philadelphia, New-York, or Boston. Now, if it be assumed that transportation by railroads, or by some better roads, steam being the impelling power, shall supersede, where practicable, *all other modes of locomotion*,—and I do not suspect myself of being alone in the opinion that there is no extravagance in such an assumption, particularly when we notice the progress of things in Europe—it is no more than seasonable to begin to contemplate, and try to foresee and act upon the natural and inevitable results which must follow, and to lay them before the public, that they may be fairly in view, and have proper consideration in the mind of every man, or company, when coming to a determination in regard to any proposed improvement, both as respects its location and the manner in which it shall be completed, or the amount of capital which may be safely invested in it.

The climate and productions of Europe and North America are so nearly alike, that as the state of science and the arts in these quarters of the world continues to come nearer to an equality, it is fair to conclude that the exchanges of merchandize will hardly keep pace with the increasing population of America. Still, as the condition of men is improving, and society and nations are becoming more intimate and

friendly in their relations, and curious in their inquiries, we may suppose that travel for gratification will greatly increase between the two—this is proved by the number and constant increase of fine ships as packets; and it fairly indicates, in connection with the extent to which steamboats are coming into use, and the long voyages which they occasionally make, that the time is not distant when the packet ships will be propelled by steam. No railroad can be laid across the Atlantic. It will be an object to have each of the two ports in Europe and America, from whence most of these ships may be expected to depart for the other, situated conveniently as it respects the interior parts of the country, and as near together as may be. The wearisomeness of a long sea voyage will render these considerations indispensable, and may lead to some changes not now much thought of.

But to leave this part of the subject for a while, and dwell more particularly on our own United States.

To attain the greatest rapidity of motion will always be an object of controlling importance, and therefore level regions will be greatly desirable for the location of the principal thoroughfares. The intercourse and exchanges between the north and the south must increase vastly beyond all precedent, and probably beyond all present anticipation of the most enthusiastic, for as speed of transportation increases, and the cost is reduced, the productions of each of the various climates will be vastly more consumed in the other climates; and the assumption is, that transportation by land will gradually take the place of water navigation, first, for persons travelling, and then for merchandize, and particularly on account of its expedition, safety, and regularity. This consideration is made stronger, from the fact that much of the interior, and the finest portion of North America, and that which will soon be the most productive and most densely settled, and of course require the greatest exchanges of this character, is already as near by land to the most important productions of southern climates, as it is to our eastern commercial ports. It is not too early, then, to begin the inquiry, where shall be our principal and leading roads? for it is plain that they are not yet located, and that they cannot be determined on judiciously without the most grand and enlarged views, and the most extensive and accurate surveys.

Without attempting to speak of details, which can of course be only determined by such surveys, it is pertinent, and may be profitable to notice, that the formation of the country and the condition and wants of the citizens, present and future, clearly indicate that the road already commenced at Albany must be continued without any regard to navigable waters, on the best and most level ground westward, indefinitely; That another road from Norfolk, or perhaps from Boston, must proceed southwardly over the level region, near the coast all the way, to some harbor, where a town is yet to spring up, near the south cape of East Florida, from whence there will be a busy steamboat intercourse with Havana; That a branch of this road will proceed, say from Savannah, to New-Orleans, and thence into Texas, and onward, onward; That another principal road will be from this new city on the Cape of Florida, into the great valley of the Mississippi. This brings me back to the thoughts which put me upon this essay, the errors likely to be made in the location of railroads. I perceive some are designed to communicate only between one inland water navigation and another. These may prosper long enough to refund their cost; but the day is not distant when they will have comparatively little value.

Finally, as your journal is likely to be extensively preserved for future reading and reference, and as I am an old man, and shall hardly trouble you many times more, I ask of you the further favor to record a few prophecies.

First, fresh water navigation, including that of the Mississippi and all its tributaries, will be discontinued, probably within twenty years.

Secondly, New-Orleans, and all cities in unhealthy situations, will greatly decline, and new cities and towns spring up in more healthful and advantageous situations, and that the queen of these will be somewhere at a point not yet thought of in the great valley.

And thirdly, that either Boston or Halifax is destined to take the sceptre from the highly favored city of the island.

And, to conclude, again I would most respectfully hint to the men of Boston (and for this I hope they will remember my children) two things—first, to spare no pains, nor grudge any capital, either in the location or construction of their westward and southward railroads; and secondly, to turn their attention to European steam packets on a large scale. I beg pardon: Boston folks need no hint from me on their own affairs. C. O.

Deep Creek, Sept. 5, 1833.

Railroad on the Banks of the Rhine.—By the Hague Journal, we learn that the Prince of Orange had returned on the 27th from the head-quarters of the army to the Hague, and thus, we believe, has put an end to the apprehensions which had been entertained by the Belgians that his presence there was the forerunner of an attack. M. Dedel, also, had arrived from London at the Hague. We see that the Dutch are making a rapid progress with steam-carriages, and railroads. Messrs. Stratingh and Becker have tried a steam-carriage on the common road at Groningen, and it has run through the town without inconvenience. This was the first experiment. It is expected that the machine will be improved. A railroad is to be laid down from Amsterdam, on the right bank of the Rhine, passing through Dusseldor and Elberfield to Duits, opposite to the harbor of Cologne, and preparations are making for carrying it into effect. The line is marked out, and Prussia is disposed to agree to the undertaking, the principal author of which is Lieutenant Colonel Bake. The capital necessary is estimated at eleven million florins, the annual expense at 70,000 florins, and the re-

ceipt at 1,300,000 florins. Such prospects are far more useful than those marchings and countermarchings of troops of which we have of late heard so much.—[London paper.]

On the Dip and Declination of the Needle.

To the Editor, &c.

Avoylle Ferry, May 7, 1834.

Dear Sir,—The application of a manufacturer of compasses, in Birmingham, (see current volume, page 191,) calling for information of the dip and declination of the needle, and its *variations*, I think a very important inquiry. In my letter to you, (I think in November, 1832, no copy before me,) I made a similar request, which was, no doubt, overlooked, or thought chimerical. I now wish to add to the manufacturer's inquiry, that the latitude and longitude of the different places be given, and say take the variation from June to December in each year, throughout America, and bring them together: in a few years that long sought problem will be settled. With the observations and actual experiments of Capt. Ross, of the *variation of the Magnetic Needle*, every practical surveyor in the United States can, at any time, give the variation of the needle, and mariners at all times and places wherever they may happen to be.

I have made these hasty remarks since closing my letter of to-day, to give you some idea of my opinions, that you may, if you choose, make some remarks from them.

Your friend and servant,

P. G. V.

We ask the attention of those of our readers who have the means and the inclination to investigate the subject of the above communication. The result of their inquiries, when attained, will always find a place in the Mechanics' Magazine. P. G. V. will please accept our thanks especially for his duplicates.

Avoylle Ferry, on Red River, La.
May 7, 1834.

To the Editor of the American Railroad Journal.

Sir,—You herewith receive the meteorological table for the month of April, 1834, regularly entered. I regret to see in the Railroad Journal, vol. 3, No. 12, that you have not received my letter of 3d January last. I now inclose you a copy of that—also, extracts from 6th December last: as they were both sent by the same mail I presume they shared the same fate. Copies of the meteorological tables for November and December are also inclosed.

Most respectfully, your obedient servant,

P. G. V.

METEOROLOGICAL RECORD, KEPT AT AVOYLLE FERRY, RED RIVER, LOU.

For the month of April, 1834—(Lat. 31.10 N., Long. 91.59 W. nearly.)

Date. 1834.	*Thermometer.* Morn'g.	Noon.	Night.	*Wind.*	*Weather, Remarks, &c.*
April 1	64	78	76	S	clear—ev'ng cl'dy—planted sweet potatoes—R. Riv. rising, below h. w. m.
" 2	68	83	62	calm	" — " severe storm, and rain from north—R. Riv. at a stand [2 f. 9 i.
" 3	58	61	59	"	cloudy—light showers all day—night clear
" 4	50	72	66	"	clear all day and night
" 5	54	72	65	"	" " "
" 6	49	71	63	"	" " "
" 7	48	74	70	"	" " " —planted S. E. field corn
" 8	52	72	68	S	cloudy all day—Red River falling
" 9	65	71	70	"	" —rain and heavy thunder from 11 A. M. and all night
" 10	60	76	72	calm	clear
" 11	64	74	64	"	"
" 12	54	75	65	"	"
" 13	56	68	62	N	cloudy—rain in the mornng—evening clear
" 14	57	72	64	calm	clear all day
" 15	54	74	70	"	" "
" 16	64	80	70	S	cloudy—rain in the morning—clear day
" 17	62	79	76	"	clear all day—commenced mowing red clover field for hay
" 18	70	82	68	"	" —evening severe gale—rain and thunder from south-west
" 19	64	74	74	calm	cloudy—evening clear—Irish potatoes, new crop, large and fine
" 20	65	80	72	S	foggy morning—clear day
" 21	70	80	76	S—high	cloudy all day
" 22	73	80	78	"	" " —heavy thunder and rain all night
" 23	66	81	76	S—light	" —rain in morning—clear day—night calm and cloudy
" 24	70	72	69	N W	" all day—rain all night, and calm
" 25	63	63	64	N E to N	" —rain and showers all day and night
" 26	55	60	59	calm	clear—foggy morning—snap beans and peas for use
" 27	57	74	70	"	" all day
" 28	56	72	69	"	" " —planted leveed field over the river
" 29	55	80	71	"	" "
" 30	69	84	73	S	" "

Red River fell this month 1 foot 2 inches—below high water, 3 feet 11 inches.

The *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. Minor and J. E. Challis, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—John Knight, (formerly proprietor of the London Mechanics' Magazine,) Editor.